ANSI/(NFPA) T2.12.10 R1-2002
Second edition
2 July 2002

Hydraulic fluid power – Systems and products – Testing general measurement principles and techniques [to be used in conjunction with ANSI/(NFPA)T2.12.10]

Revision of ANSI/(NFPA)T2.12.10-1993

A NATIONAL INDUSTRY STANDARD FOR FLUID POWER

Approved by Committee ASC B93,
accredited by the American National Standards Institute (ANSI)

Descriptors: calibration data reduction errors contribution model hydraulic fluid power instrument uncertainty precision parallax principles techniques random readability steady state systematic testing general measurement instrument

Developed and published by

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Published by
NATIONAL FLUID POWER ASSOCIATION, INC.

Printed in USA

Foreword

At the NFPA/T2.12 meeting on 19 May 1998, Mr. John Montague (Bosch Automation Technology) reviewed his proposal to retain ANSI/(NFPA)T2.12.10-1993 as a National Fluid Power Association (NFPA) document instead of withdrawing it and drafting an ISO document. Mr. Montague provided written justification to the Technical Board, for their approval, to retain this document.

At the 29 September 1998 NFPA/T2.12 meeting, members reviewed and approved the Title, Scope and Purpose (TSP) with changes to the co-ordination clause. Members approved a recommendation to submit the TSP to the Technical Board for approval.

At the 9 February 1999 NFPA/T2.12 meeting, a revised TSP was reviewed and a motion was approved to submit it to the Technical Board for approval. A copy of the proposed revisions to the document were distributed and discussed. A motion was made to recommend submitting the revised practice for general review, contingent upon Technical Board approval of the TSP.

At the 8 April 1999 Technical Board meeting, members approved the NFPA/T2.12 recommendation for approval of the NFPA/T2.12.10 R1-200x TSP, concurrent with submission of a new work item to U.S. TAG to ISO/TC 131/SC 8.

At the 8 February 2000 project group meeting, members reviewed the comments received from the general review ballot, circulated 18 November 1999 and closed 18 December 1999, and made changes to the document. Members approved a recommendation to final ballot of NFPA/T2.12.10 R1-200x, pending completion of the comment approval letters. Members would review comments received from the final ballot at the September 2000 meeting.

At the 16 May 2000 project group meeting, members were informed that the circulation of NFPA/T2.12.10 R1-200x for final ballot was not completed because Technical Board members had tabled the NFPA/T2.12 recommendation of final ballot approval due to unavailability of feedback from project group members. Members reviewed and made corrections to draft no. 3. Mr. Montague had prepared a proposal for the revision of ISO 9110-1:1990 and ISO 9110-2:1990. Mr. Montague agreed to attend the August 2000 Technical Board meeting to recommend that NFPA/T2.12.10 R1-200x be approved for final ballot. Members would review final ballot results and resolve comments at the September 2000 meeting.

Project group members who developed this standard:

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On 19 March 2003, ANSI/(NFPA)T2.12.10 R1 was submitted to ANSI Accredited Standards Committee B93 (ASC B93) for ballot. On 19 November 2003, the document was submitted to ASC B93 for a follow-up ballot. Balloting closed with no negative comments.

ANSI/(NFPA)T2.12.10 R1 was approved by ANSI's Board of Standards Review on 19 February 2004.

The membership roster of ASC B93 at the time of ballot:

Jack C. McPherson
Chairman

Karen Boehme
Secretary and Staff Liaison

American Society of Agricultural Engineers
Scott Cedarquist

The Association for Manufacturing Technology
Paul Warndorf

Compressed Air & Gas Institute
John Addington

Fluid Controls Institute
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Fluid Power Distributors Association
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Introduction

In hydraulic fluid power systems, power is transmitted and controlled through a liquid under pressure within an enclosed circuit.

A fundamental aspect of fluid power technology is the need to quantify the performance characteristics of hydraulic components and systems to provide a basis for action or decision-making.

Universal measurement standards are required if meaningful comparisons are to be made and valid conclusions deduced.

Two aspects of measurement are uncertainty and parameter regulation control. This recommended practice provides guidance for identifying error sources and magnitudes in the calibration of instruments and their use in measurement situations encountered in hydraulic fluid power testing. Methods are described for assessing the uncertainty in measurements and derived results. Standardized values for allowable error limits and parameter control tolerances are presented for four classes of measurement uncertainty: A, B, C and S.

It is widely recognized that no measurement, irrespective of the amount of care exercised, can ever be absolutely accurate and free of error. Different circumstances each have unique uncertainty requirements. The value of a measurement is dictated by the use that will be made of it, as well as the particular circumstance. Therefore, the maximum value of a reported measure can only be realized if it can be applied under many different circumstances, requiring that the uncertainty associated with a measure be assessed and reported.

Annex E provides a tutorial for the various clauses of this recommended practice.

This recommended practice is intended to be used in conjunction with others that address the measurement of specific physical parameters: flow, pressure, torque, speed and temperature.

Recommended practice – Hydraulic fluid power – Systems and products – Testing general measurement principles and techniques

1 Scope

Use of this recommended practice shall be limited to measurement situations encountered in the testing of hydraulic fluid power components or systems under static or average steady state conditions and include:

a) general instrument calibration techniques;

b) methods for assessing instrument uncertainties and measurement uncertainty;

c) evaluation methods for error propagation in derived results;

d) measurement system uncertainty assurance control techniques;

e) criteria for system measurement acceptance.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this NFPA document. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this NFPA document are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referenced applies. NFPA maintains registers of currently valid NFPA and ANSI/(NFPA) Standards. Standards development organization contact information and links can be found on the NFPA website **(www.nfpa.com)**.

ISO 1000 *(latest edition), SI units and recommendations for the use of their multiples and of certain other units*.

ISO 5598 *(latest edition), Fluid power systems and components – Vocabulary*.

IEEE/ASTM SI 10 *(latest edition), Standard for Use of the International System of Units (SI): The Modern Metric System*.

ISO Guide to the Expression of Uncertainty in Measurements, (latest edition) ISBN 92-67-10188-9.

ASTM Manual 7 *(latest edition), Manual on Presentation of Data and Control Chart Analysis*.

ANSI/ASQC B1-B3 *(latest edition), Guide for Quality Control Charts, Control Chart Method of Analyzing Data, Control Chart Method for Controlling Quality During Production*.

NFPA/T2.12.2 *(latest edition), Hydraulic fluid power – Systems and products – Method of reporting traceability of measurement*.